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INFORMATION REPORT INFORMATION REPORT

CENTRAL INTELLIGENCE AGENCY

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COUNTRY USSR

REPORT

SUBJECT Description and Operating Instructions for the Soviet RPN-47 Radio Direction Finder - apparently naval because of refs to hulls + decks of ships! RR comment

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THIS IS UNEVALUATED INFORMATION. SOURCE GRADINGS ARE DEFINITIVE. APPRAISAL OF CONTENT IS TENTATIVE

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1. 39-page, English-language Soviet document entitled Radio Direction Finder RPN-47: Description and Operating Instructions. No publishing data were given on the document.

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2. The direction finder is designed to take bearings on omnidirectional radio beacons and radio stations, and to pick up signals of directional radio beacons. The RPN-47 exists in three types: RPN-47-01, RPN-47-02, and RPN-47-03, which differ from one another in the construction of the antenna and in the exterior wiring systems. The booklet contains a description of the apparatus and the circuit, and operating instructions.

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RADIO DIRECTION FINDER RPN-47

Description and Operating Instructions

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RADIO DIRECTION FINDER
РПН-47

DESCRIPTION AND OPERATING INSTRUCTIONS

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S e c t i o n I

DESCRIPTION OF RADIO DIRECTION FINDER PIH-47

1. Components

There are three types of PIH-47 radio direction finder: PIH-47-01, PIH-47-02, PIH-47-03. The radio direction finder is designed to take bearings on omnidirectional radio beacons and radio stations and to pick up the signals of directional radio beacons. The three types of radio direction finder differ from one another by construction of frame aerials and exterior wiring systems.

All types of radio direction finder consist of the following components:

(a) frame aerial;

(b) auxiliary aerial;

(c) exterior wiring;

(d) interior wiring;

(e) receiver and goniometer unit;

(f) signal panel;

(g) tester;

(h) supply cable;

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(i) supply sources:

1. rectifier,

2. single-armature converter CN-120;

(j) supply board.

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2. Frame Aerial of Radio Direction Finder PPH-47-01 and PPH-47-02

The frame aerial shown in Figs 1 and 2 consists of two shielded frames fitted at right angles to each other and mounted on a special support K,1435 mm in height, which has a feeder run through it.

The support is a duralumin pipe 85/77 mm in diameter which has a lower flange NPK for mounting to the deck and holes in the corner-plates of an upper flange BPK for guys. To regulate tension the guys have turnbuckles. To ensure connection with the exterior wiring the support base terminates in OM coupler with a gland.

The connection between the upper support flange BPK with the lower frame flange NPP is provided by bolts. When the frame is installed on the support the coupler with the gland located under the frame lower flange is removed. The frame of radio direction finder PPH-47-01 is 1200 mm in diameter, the winding has 4 turns (See Fig.1). The frame of radio direction finder PPH-47-02 is 600 mm in diameter, the winding has 8 turns (See Fig.2).

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The winding is wound round distance pieces into duralumin pipes T 30/27 mm in diameter, which serve as a shield.

The upper joint B is made of insulating material. The ends and the centre points of the frame winding are connected to the terminal board of the frame.

For access to the terminal board a special lid-closed port O is used.

The frame 1.2 m. in diamter has a metal rod III fixed in the centre to make the construction more rigid.

The frame aerials of PUH-47-01 and PUH-47-02 are constructed so that they can also be installed without a support.

Frame Aerial of Radio Direction Finder PUH-47-03 (Figs 3 and 4)

The frame aerial consists of two shielded frames 600 mm in diameter fitted at right angles to each other.

Each frame consists of two half-rings K, soldered to bosses II of the base.

The half-rings of the frame are made of brass pipes, 34/30 in diamter, whose lower halves are covered with pipes K_2 with a diamter of 38/45 to make the construction more rigid.

The winding of frame KP has 6 turns of wire passing

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through the openings in distance pieces B. The dist 50X1-HUM
pieces are fixed on C/4 diameter pipe I which serves at the same time as a guide for distance pieces and a pipe to deliver warm air to the frame upper joint when the frame is blown through.

The frame base has a terminal plate PI placed on special bosses II (Figs 4 and 5). The terminal plate has four holes for applying the exterior wiring to frame ends.

The frame is oriented and installed according to SHIP'S HEADING (HCC) mark designated on the corner-plate and is secured with bolts having diameter 16 mm.

3. Exterior Wiring of Radio Direction Finders PPH-47-01 and PPH-47-02 (Fig.6)

The exterior wiring consists of two two-conductor cables, type РД-16, arranged alongside. To ensure normal operation R.D.F. PPH-47-01 uses wiring 20 m. long and R.D.F. PPH-47-02 - wiring 6 m. long.

Exterior Wiring of Radio Direction Finder PPH-47-03 (Fig.5)

The exterior wiring of radio direction finder PPH-47-03 is mounted in four pipes with diameter 55/50 tightened by 7 flanges. One end of the pipe (upper) is soldered to the upper flange, the other end (lower) is soldered to the connection flange which in conjunction with the reinforcing plate is secured to the pressure hull.

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The upper flange of the wiring has a plate through which wires are led to frames. The plate has a pipe screwed into it, which conducts warm air to blow the frame.

The exterior wiring terminates in the lower joint fixed to the ship's hull.

The wires of the exterior wiring are soldered to the busbars of the lower joint. Wires are provided to connect the busbars to the plugs of the connector. To ensure proper wiring the plugs of the connector have special designations P_{I-I}, P_{I-2}, P_{II-1}, P_{II-2}, indicating the order of connection of the frame winding ends to the plugs.

4. Interior Wiring

The interior wiring uses four-core wire, type PHH, in metal braiding:

(a) radio direction finders PHH-47-01 and PHH-47-02 use a wire, 1.5 m. long, one end of which is arranged in the junction box whereas the other is provided with a connector for coupling to the receiver and goniometer unit;

(b) radio direction finder PHH-47-03 uses a wire, 3 m. long, whose ends terminate in connectors for coupling to the lower joint of exterior wiring and to the receiver and goniometer unit.

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5. Auxiliary Aerial

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The radio direction finders in question employ different types of auxiliary aerials. R.D.F. PIH-47-01 uses a vertical aerial 8 m. long.

In case of R.D.F. PIH-47-02 use is made either of a gamma aerial 4 m. long or of a rod aerial of identical length.

The aerial used with R.D.F. PIH-47-01 and PIH-47-02 are made of flexible aerial wire having 10 mm^2 in cross-section. One end of the aerial is provided with three egg insulators, two guy thimbles and a rope which is 12 m. long in case of R.D.F. PIH-47-01 and 8 m. long in case of R.D.F. PIH-47-02. For aerial suspension use is made of three additional insulators.

The aerial lead-in when assembled is connected to the receiver and goniometer unit according to Fig.6.

R.D.F. PIH-47-03 employs a telescopic aerial 15 to 20 m. long.

Maximum capacitance of the aerial lead-in and interior wiring equals 1,000 µµF.

Note: Use of other types of aerials with R.D.F. PIH-47-03 is quite possible but it should be borne in mind that in this case the input circuit tuning spread during omnidirectional reception as well as factors of directional and omnidirectional receptions will be somewhat different.

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6. Receiver and Goniometer Unit

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The receiver and goniometer unit is a seven-valve superheterodyne receiver with a goniometer. The goniometer front panel is provided with a scale device consisting of an outer (rotating) scale and an inner (fixed) scale with a recess to plot the residual radiodeviation curve. The curve is plotted with an ordinary black pencil and is wiped off with a damp rag, if needed no longer. To prevent the curve from being wiped off accidentally, the recess is covered with two transparent half-discs. The indicator has a longitudinal scale to read the value of residual radiodeviation off the graph.

The scale device of the goniometer is lighted from within by three lamps arranged circumferentially in three points.

Circuits of the frame and auxiliary aerial (of all types) are provided with anti-radar filters.

The receiver of the radio direction finder can pick up modulated, continuous and tone-modulated signals.

The receiver covers a frequency range from 750 Kc/s to 186 Kc/s (400-1600 m.) in two bands:

1st band from 186 Kc/s to 376 Kc/s (1600-800 m.);

2nd band from 375 Kc/s to 750 Kc/s (800-400 m.)

By turning the selector switch reception is switched over from one band to the other. One knob is used to tune in receiver. Volume control is manual. The headphones are

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connected to the receiver output: in case of one pair headphones the middle jacks are used and in case of two pairs - the end ones.

All assemblies and components, both of the receiver and of the goniometer are mounted on a special panel and chassis. The entire wiring is arranged under the chassis. The high- and intermediate-frequency circuits, the capacitor unit, the valves and low-frequency chokes are mounted over the chassis.

7. Supply Sources

The receiver may be supplied either from A.C. mains or from D.C. mains. When fed from A.C. mains, voltage is applied to the rectifier terminals designated MAINS (CETb). The rectifier voltage switch is set to the position corresponding to the voltage applied: 110 V, 127 V or 220 V. When supplied from D.C. mains, voltage is applied to the single-armature converter CH-120 by way of the supply board. Mains voltage is applied to the rectifier terminals marked CH-120. Thus in both cases described above the receiver is fed from the rectifier.

8. Rectifier

The rectifier fully ensures the radio receiver supply from 110, 127 or 220 V. A.C. mains.

The rectifier uses valve 5Ц4С in a full wave

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rectifying circuit. For a diagram showing the switching over of transformer mains winding see Fig.7. The rec50X1-HUM voltage circuit employs a two-stage smoothing filter which consists of two low-frequency chokes and three 10 μF electrolytic capacitors.

Besides, the receiver and goniometer unit uses electrolytic capacitor 9μ to provide better filtration of the rectifier plate voltage.

The front panel of the rectifier chassis mounts terminals for coupling to the A.C. mains, terminals for connecting ОП-120 converter, terminals for coupling the receiver supply cable (receiver plate and filament circuits) and a terminal which connects the ground wire.

The right-hand side panel mounts a fuse and supply tumbler switch which ensures the rectifier connection either to the A.C. mains or to the ОП-120 converter.

9. Description of ОП-120 Single-Armature Converter

The ОП-120 converter is a single-armature converter used to convert 110 and 220 V direct current into 127 V alternating current with a 50 c.p.s. frequency. Filters and a noise killer are built into its casing.

Filters reduce the radio interference produced during the converter operation thus enabling the operator to receive the transmitter with the converter operating.

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The noise killer is a casing made of 2 mm aluminium and provided with partitions. The casing and partitions inside are padded with felt.

The single-armature converter is rated for continuous duty. The converter is enclosed and self-ventilated.

Ratings of the converters:

	OB-120 Ø-4		OB-120 Ø-5	
1. Power output	120 W,	120 W	90 W,	150 W
2. D.C. supply voltage	220 V,	220 V	110 V,	110 V
3. A.C. voltage output	127 V,	127 V	127 V,	127 V
4. Current consumed	1.1 A,	1.5 A	1.7 A,	2.3 A
5. Load current	1.3 A,	1.3 A	0.8 A,	1.354 A
6. Power factor	0.7	0.9	0.9	0.9

For the diagram of the converter with the filter see the key diagram of the radio direction finder (Fig.7).

The converter should be inspected and maintained regularly in accordance with the maintenance instructions.

10. Signal Panel

The signal panel is a casing housing a signal lamp and a tumbler switch for switching on the signalling system.

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S e c t i o n II

DESCRIPTION OF RADIO DIRECTION FINDER CIRCUIT

1. Input Circuit

For reception of signals of directional radio beacons, switch Ref.154 is set to OMNIDIRECTIONAL RECEPTION (КРУГОВОЙ ПРИЕМ) (О) (See Fig.7). The signal picked up by the aerial is delivered to the input circuit of the control grid circuit of the first high-frequency amplifier valve. The circuit consists of a search coil equivalent Ref.26, rotor coil of compensation variometer Ref.27, tuning capacitors of input circuit Ref's 51 and 52, trimmer of input circuit Ref.50, and of coils one of which is shunting in the 2nd band Ref.29 and the other - lengthening in the 1st band Ref.30.

Direction finding is determined when switch Ref.154 is turned to DIRECTIONAL RECEPTION (НАПРАВЛЕННЫЙ ПРИЕМ) (СО). In this case the signals are received simultaneously by the frame and the auxiliary aerial. The signal picked up by the frame is applied to field coils Ref.21 of the goniometer and is induced in search coil Ref.23 coupled to the

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receiver input circuit which consists of capacitors Refs 50, 51, 52 and inductance coils Refs 27, 29 and 30.

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The signal picked up by the aerial is delivered to stator Ref.28 of the compensation variometer, coupled inductively with rotor Ref.27 which is series-connected with the search coil of the goniometer. The compensation variometer rotor is connected with the shaft of switch Ref.154 which makes it possible to rotate the rotor through 180° when the switch is set to CO.

In order to find the direction of the transmitting radio station it is necessary to turn switch Ref.154 to cardioid reception position (designated by the red and green cardioid symbol). With the switch in this position the signal is taken from the ferrod to auxiliary search coil Ref.23, inserted in place of search coil Ref.22, through lengthening coils Refs 24 and 25. Auxiliary search coil Ref.23 is wound at right angles to main search coil Ref.22, due to which reception is maximum when the main search coil is at minimum. By setting switch Ref.154 in the or positions (showing the orientation of cardioid pattern) the ends of the auxiliary search coil are switched over. The signal picked up by the aerial is then transferred (in both cardioid reception positions of switch Ref.154) through phasing resistors Ref.106 (2nd band) and Ref.107 (1st band) to the input circuit.

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2. High-Frequency Amplifier

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High-frequency oscillations from the input circuit are taken through block capacitor Ref.55 to the control grid of the first valve (6Ж4). Resistor Ref.110 serves as a grid leak. Resistor Ref.111 damps excess voltage applied to the screen grid and, together with capacitor Ref.101, serves as a decoupling. Capacitor Ref.64 and resistor Ref.108 serve as a decoupling in the supply circuit of the valve plate. Block capacitor Ref.66 prevents a plate short circuit, in case there is a contact between the rotor and the stator of the capacitor unit section Ref.53.

Resistor Ref.119 ensures automatic bias and is blocked at high frequency by capacitor Ref.79.

The high-frequency amplifier stage is a resonance amplifier based on valve 6Ж4 and it has auto-transformer coupling with the oscillating circuit in the grid circuit of the 1st amplifier.

In the 2nd band the circuit components include coil Ref.31, trimmer Ref.58 and capacitor Ref.53.

In the 1st band the stage circuit components comprise capacitor Ref.53, coil Ref.32, and trimmer Ref.59. The circuits are switched over with the contact section of band selector $П_2$. Each contact section of the band selector has contacts which short the inoperative circuit.

Circuit coils Refs 31 and 32, trimmers Refs 58 and 59,

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contact section of band selector Π_2, block capacitors 50X1-HUM
Ref.66 and 67 and resistor Ref.112 of control grid leak of valve 6A7 Ref.145 are mounted in the common screen.

3. Converter

The converter stage combines the functions of the 1st detector and those of the 1st heterodyne.

From the circuit of the high-frequency amplifier stage oscillations are delivered through block capacitor Ref.67 to the control grid of valve 6A7 Ref.145.

The 1st heterodyne employs Hartly circuit with plate (screen grid of valve 6A7) earthed at high frequency through capacitor Ref.69. Resistor Ref.113 and capacitor Ref.68 form grid leak of the heterodyne.

The first heterodyne is tuned by variable capacitor Ref.54 which is the 4th section of the capacitor unit. The oscillating circuit of the 1st heterodyne consists of capacitor Ref.54, coil Ref.33, padding capacitor 62, trimmer Ref.60, and fixed capacitor Ref.65 which balances the initial capacitance of the circuit, in the 2nd band and of capacitor Ref.54, coil Ref.34, capacitor Ref.63, trimmer Ref.61, and fixed capacitor Ref.65 which balances the initial capacitance of the circuit, in the 1st band.

The circuits of the 1st heterodyne are switched from one band to the other with section Π_3 of the band selector.

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Coils Refs 33 and 34, trimmers Refs 60 and 61, capacitors Refs 62, 63, and 65, contact section of band selector 3, as well as resistor Ref.113 and grid leak capacitor Ref.68 are arranged in common screen.

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Direct voltage is applied to the valve screen grid through resistor Ref.114, which ensures the necessary voltage value and, together with capacitor Ref.69, forms a decoupling in the screen grid circuit.

Oscillations of the incoming signal and those of the first heterodyne are mixed to produce 110 Kc/s differential or intermediate frequency in the plate circuit of the valve.

The first intermediate-frequency band pass filter consists of two circuits, connected through capacitor Ref.76. The plate circuit consists of coil Ref.35 and capacitor Ref.70. The grid circuit consists of coil Ref.36 and capacitor Ref.71. Resistors Refs 129 and 130 are used to widen the pass band. Direct voltage is applied to the plate of valve 6A7 through a decoupling filter consisting or resistor Ref.115 and capacitor Ref.80.

4. Intermediate-Frequency Amplifier

The intermediate-frequency amplifier consists of two stages based on valves 6K7 Refs 146 and 147.

The load in the plate circuits of the I-F amplifier valves is the 2nd and 3rd band pass filters. Besides, an bus

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been previously mentioned, intermediate frequency is also amplified in the converter stage whose plate load is 50X1-HUM 1st band pass filter.

Intermediate-frequency band pass filters are inserted between valves Refs 145 and 146, 146 and 147, 147 and 148. Each intermediate-frequency band pass filter consists of two oscillating circuits with external capacitance coupling.

All circuits of the intermediate-frequency amplifier are tuned to resonance with a frequency equal to the intermediate frequency. Each circuit consists of an inductance coil, a fixed capacitor, and a resistor which serves to widen the pass band.

Each circuit is a coil housed in cup of carbonyl iron placed in carbolyte body. The circuits are trimmed by changing the coil inductance which is accomplished by moving carbonyl iron cores inside the cups. The coils of each band pass filter circuit are shielded, therefore there is no inductive coupling between them. Decoupling filters consisting of resistors and capacitors are inserted in the plate and screen circuits of the intermediate-frequency amplifier valves.

Given below is a table of the diagram reference numbers of the inductance coils, resistors and capacitors in the 1st and 2nd intermediate-frequency amplifier stages.

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I-F amplifier stage	1st	2nd
Circuit inductance coils	37, 38	39, 40
Circuit capacitors	73, 75	74, 75
Circuit resistors	134, 135	136
Decoupling capacitors	81, 82, 83	84, 85, 98
Decoupling resistors	117, 118	120, 121

To develop bias on the control grids of valves Refs 146 and 147, resistors Refs 138 and 152 are connected to their cathodes. Besides, potentiometer rated for 22 kilohms Ref.126 is used to adjust gain. The potentiometer is connected so that the gain of both valves changes simultaneously.

To increase the depth of gain adjustment resistor Ref.116 is connected to the valve cathodes.

The cathodes of both valves are blocked at high frequency by capacitors Refs 84 and 98.

5. Second Detector and First Stage of Low-Frequency Amplifier

The heterodyne grid and the cathode of valve 6A7 Ref.148 are used as the 2nd detector in receiving phone signals (with the 2nd heterodyne switched off). The intermediate frequency oscillations taken from the 3rd band pass filter are applied to the heterodyne (first) grid of the

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the valve. The voltages of valve 647 are so rated that the intermediate-frequency oscillations are detected by the grid detection method. Detection results in low-frequency oscillations being developed on resistor Ref.122 which forms the load of the 2nd detector.

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The pentode portion of valve Ref.148 is used as a preliminary low-frequency amplifier. The low-frequency oscillations are amplified by the pentode portion of the valve and are developed on the load of the amplifier-resistor Ref.124.

To decouple the plate circuit of the valve from intermediate-frequency currents capacitor Ref.89 is inserted in the plate-ground circuit.

For reception of continuous oscillations (with the 2nd heterodyne switched on) valve Ref.148, used for variation detection, is employed as the 2nd detector. Intermediate-frequency oscillations, as in case of voice reception, are applied to the first grid of the valve. Besides, the 2nd heterodyne oscillations are delivered through block capacitor Ref.100 to the control (third) grid of the valve. The beat of intermediate-frequency oscillations and those of the 2nd heterodyne results in low-frequency oscillations developed on the plate load of valve Ref.124. The frequency of the I-F oscillations produced can be changed by means of the 2nd heterodyne tone detuning capacitor.

The screen grid of valve Ref.148 is fed through a

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decoupling filter, which consists of resistor Ref.123 and capacitor Ref.87.

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6. Second Heterodyne

The second heterodyne (valve 6K7) generates oscillations equal to the intermediate frequency or differing from it by approximately ±2500 c.p.s. The oscillation frequency of the heterodyne is continuously adjustable within these limits by turning the knob of the second heterodyne capacitor.

The oscillating circuit of the second heterodyne consists of coil Ref.44 and fixed capacitor Ref.99, connected in parallel with variable capacitor Ref.96, which serves to detune the beat note. Resistor Ref.133 and capacitor Ref.93 serve as a heterodyne grid leak. Resistor Ref.131, and capacitor Ref.97 are used for decoupling in the plate supply circuit.

The second heterodyne is switched on for operation in direction finding and in reception of continuous oscillations. When receiving modulated oscillations, the second heterodyne is switched off with a two-pole switch Ref.156 (tone detuning knob being in the extreme left fixed position).

7. Low-Frequency Amplifier

The low-frequency amplifier consists of two stages. The preliminary low-frequency amplification stage was

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described previously. 6Ж5 valve Ref.150 is used as low-frequency amplifier. Through block capacitor Ref.83 low-frequency oscillations are delivered to the control grid of the valve 6Ж6. Resistor Ref.125 is grid leak of the control grid. Applied to the control grid of valve Ref.150 is automatic bias taken from choke Ref.43 in the valve cathode circuit. The load of the output stage is a pair of headphones. Power supply is delivered to the valve plate through choke Ref.42. Capacitor Ref.91 is a block capacitor. Capacitor Ref.92 clips modulation high frequencies above 3000 c.p.s. Resistor Ref.127 and capacitor Ref.94 serve as a decoupling in the supply circuit of the valve screen grid.

Choke Ref.43 is connected into the cathode circuit of valve 6Ж6 to develop negative feedback at high frequency which reduces combination interference produced by the harmonics of the 2nd heterodyne.

For reception of continuous oscillations a low-frequency filter, consisting of choke Ref.41 and capacitor Ref.90, is inserted in the control grid circuit of output low-frequency amplification stage. For reception of modulated oscillations choke Ref.41 is shorted. The filter is switched on with the second pair of contacts of tumbler switch Ref.196.

The low-frequency filter is designed to reduce noises

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by narrowing the frequency pass band of the low-frequency amplifier thus increasing sensitivity of the receiver.

The resonance frequency of the filter is about 900 c.p.s. Capacitor Ref.90 is used to correct the resonance frequency of the filter.

8. Fuse

Fuse Ref.152 is inserted in the high-voltage negative circuit. The function of the fuse is to protect the plate supply source from a short circuit in the receiver circuits.

9. Measuring the Supply Voltage

The front panel of the radio receiver has a voltmeter with a push-button. When the button is released, the voltmeter reads the filament voltage. When the button is pressed, the voltmeter measures the plate voltage. The valve voltages are measured with a special tester.

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S e c t i o n III

OPERATING INSTRUCTIONS

1. Preparing Radio Direction Finder for Use

The following should be done to prepare the radio direction finder for operation:

(a) switch on the necessary supply of the receiver on the supply board;

(b) check and adjust filament voltage of the receiver valve supply;

(c) set the BEAT NOTE (ТОН ПРИЕМА) knob to the zero of the scale;

(d) turn the MANUAL VOLUME CONTROL (РРТ) knob to the right as far as it will go;

(e) set the BAND (ДИАПОЗОН) knob to the corresponding frequency band.

2. Omnidirectional Reception

(a) Set RECEPTION PATTERN (ДИАГРАММА ПРИЕМА) switch to the O position (omnidirectional reception);

(b) Turn the TUNING (НАСТРОЙКА) knob within that

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sector of the receiver dial which corresp50X1-HUM the frequency of the transmitter until the signal of the latter becomes audible: then tune to the zero beat. It will be an indication of fine tuning;

(c) turn the BEAT NOTE knob to the right and left from the zero position until you get a desirable beat note in the headphones. To pass over to reception of modulated oscillations, turn the BEAT NOTE knob to the left to a fixed MODULATION (МОДУЛИРОВ.) position;

(d) turn the ALIGNMENT knob to get maximum volume;

(e) operate the VOLUME CONTROL (РРГ) knob to get suitable volume.

3. Direction Finding:

After tuning to the radio beacon, do the following:

(a) for reception of continuous oscillations set the RECEPTION PATTERN switch to the COMPENSATION position (marked ⊂⊃);

(b) turn the ALIGNMENT knob to get maximum volume;

(c) by turning the goniometer knob, set the indicator pointer to read minimum reception and begin to determine the direction of the transmitter. Set the RECEPTION PATTERN knob first in one and then

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in the other fixed direction finding position, if the colour of cardioid (3), corresponding to the weakest signal of the transmitter is not green, turn the goniometer knob through 180°. That will reduce the signal of the transmitter to a minimum when the RECEPTION PATTERN knob points to the green cardioid (2). That, in its turn, will show that the position of the indicator pointer of the goniometer knob is correct, and that you may proceed to accurate direction finding;

(d) set the RECEPTION PATTERN knob to the COMPENSATION position. Turn alternately the goniometer and the COMPENSATION knobs until you get accurate minimum reception of the transmitter signals.

Relative bearing of the transmitter uncorrected for radiodeviation, is read off the goniometer inner scale after minimum reception has been obtained.

Set the movable scale of the goniometer to the ship's true bearing, and the indicator pointer will read bearing uncorrected for radiodeviation.

Example: When taking bearing on some radio station we determine that the relative bearing uncorrected for deviation equals 80° (The relative bearing is read off the inner fixed scale). The ship's present true bearing is 250°.

Set the goniometer rotating scale to the ship's true bearing so that 250° on it coincides with the zero of the inner fixed scale.

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The indicator pointer reads the bearing uncorrected for the radiodeviation on the rotating scale. It equals 350°.

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To find the true bearing it is necessary to apply the correction for radiodeviation shown on the residual radiodeviation curve which is plotted on the goniometer inner scale. The value and polarity of residual radiodeviation are read from the indicator scale.

When receiving powerful radio stations, adjust the volume of the signal received with the volume control (PPT) knob.

When locating weaker radio stations with a large angle of silence, the precise reading is determined as an average of the two positions with equal signal strength. For example, the angle of silence is contained between the readings 41° and 47°, the precise reading will be:

$$\frac{41^{\circ} + 47^{\circ}}{2} = 44^{\circ}$$

4. Maintenance of Radio Direction Finder

Operating personnel should systematically check the condition of the radio direction finder in operation, keep it clean, periodically wipe and grease the goniometer collectors.

To ensure normal functioning and longer service of radio direction finder PUR-47-03, the exterior wiring system and the frame should be systematically dried with dry warm air.

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The exterior wiring system is dried by warm air supplied by compressor through boss of upper flange from which the nut is unscrewed before the drying procedure.

Warm air, passing through the frame aerial and exterior wiring, escapes through the pipe of the lower joint 4; prior to drying procedure the nut of the lower joint boss is unscrewed.

As a rule, the drying should be done at least twice a month. The drying time is from 20 to 30 minutes. After the drying the nuts should be tightly and securely screwed on.

5. Faults of Radio Direction Finder

Operating personnel must carefully check the condition of terminals and contacts of the radio direction finder, systematically inspect and timely repair them.

If the receiver and goniometer unit has to be opened for valve replacement or other purposes, unscrew two screws (at the side rims of the front panel) marked ATTACHMENT (КРЕПЛЕНИЕ) and pull the receiver out.

As the contacts are arranged outside the goniometer, it is not necessary to open the goniometer screen.

In case of serious trouble the defective element of the radio direction finder should be sent to a repair shop. If the fault is not serious, repairs should be made on the spot, making use of the key diagram, with the tools supplied with the direction finder.

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Given below is a chart of faults which may occur. The chart, naturally, does not cover all possible faults that may arise.

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6. Trouble and Remedies

Trouble	Cause	Method of detection	Remedy
1	2	3	4
1. No sound in headphones.	(a) Fuse in receiver burnt out.	(a) No deflection of voltmeter needle when button is pressed.	(a) Replace fuse.
	(b) No contact in supply circuit.	(b) Check if supply circuits are correctly connected and if panel fuses are intact.	(b) Make sure connections are correct. Replace fuse.

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1	2	3	4
	(c) One or more valves burnt out.	(c) Check valves with tester.	(c) Replace defective valve.
	(d) No contact in phone plug.	(d) Phone plugs in jacks.	(d) Bend apart plug pins of phone board.
	(e) Breakdown of electrolytic capacitor.	(e) See that the fuse is intact	(e) Replace capacitor and fuse. Note: When replacing electrolytic capacitors Refs 94 and 95 unscrew two screws (on the under side of chassis) securing the electrolytic capacitor unit, pull out the unit and remove the holders of electrolytic capacitors.

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1	2	3	
2. Receiver operates, noise audible, but no reception or received signals too weak.	(a) No contact in connections of frame unit.	(a) Inspect jacks and plugs of wiring connectors.	(a) Improve contact.
	(b) No emission in one or more valves.	(b) Check valves with tester.	(b) Replace defective valves.
3. Loud crackling and fading.	(a) Poor contact between casings of station parts.	(a) Pull at flexible cables causing thereby stronger crackling.	(a) Improve contact.
4. Loud crackling as goniometer rotor is turned.	(a) Rotor brushes slipped off collectors.	(a) Inspect brushes.	(a) Put brushes back in their places.
	(b) Collector slip rings dirty.	(b) Inspect collector.	(b) Clean groove of slip rings with thick thread.

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1	2	3	4
5. Accurate minimum during bearing determination fails to be obtained.	(a) Aerial is not connected or broken. (b) Aerial not long enough. (c) Breakage in variometer aerial circuit.	(a) Inspect aerial. (c) Check circuits of AERIAL and EARTH terminals with function switch in co position.	(a) Connect aerial. remove breakage. (b) Replace aerial. (c) To be remedied by experienced base personnel.
6. Minimum axis bend is more than one degree.	(a) Aerial too long. (b) Poor contact in frame circuit.		(a) Shorten aerial. (b) Improve contact.
7. No directon finding (same loudness in both fixed and positions of cardioid marks).	(a) Breakage in auxiliary search coil circuit.		(a) To be repaired at repair base.

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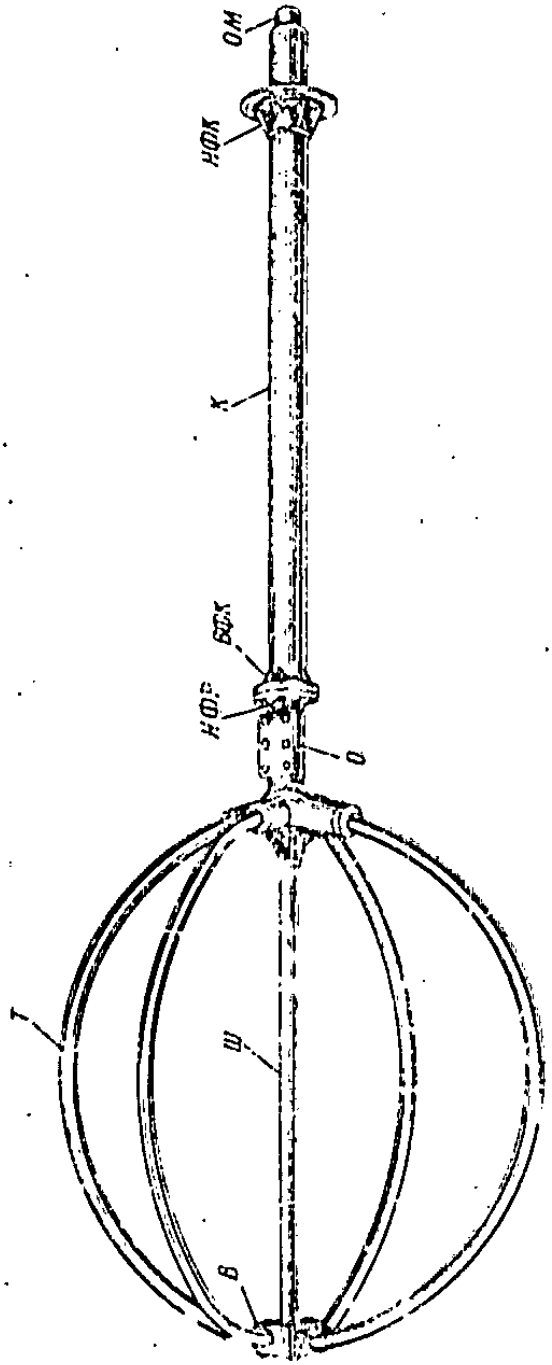

Fig.1 Frame Aerial of Radio Direction Finder РПН-47-01 with Support

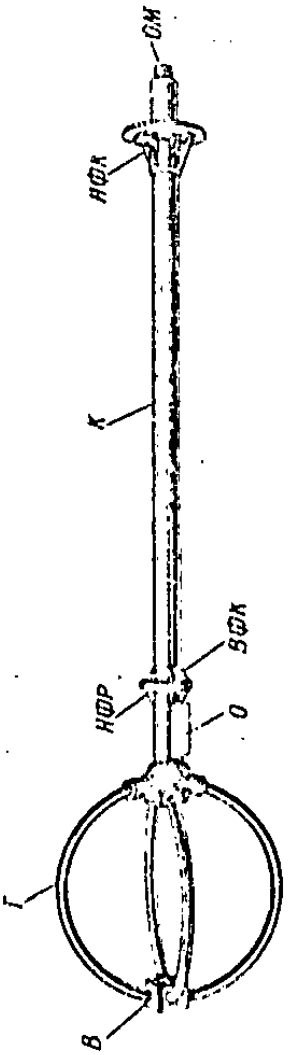

Fig.2. Frame Aerial of Radio Direction Finder РПН-47-02 with Support

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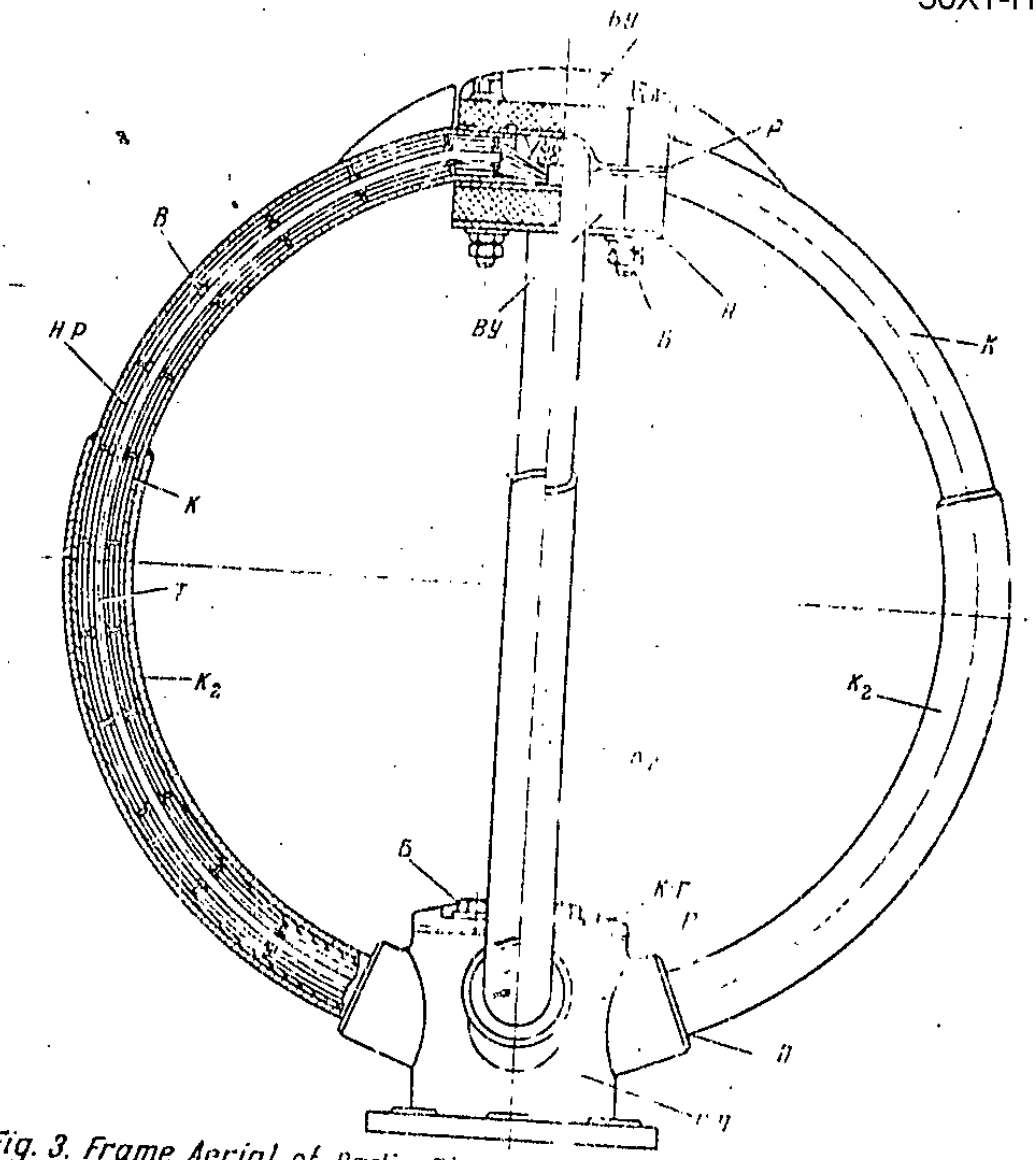

Fig. 3. Frame Aerial of Radio Direction Finder РПН-47-03

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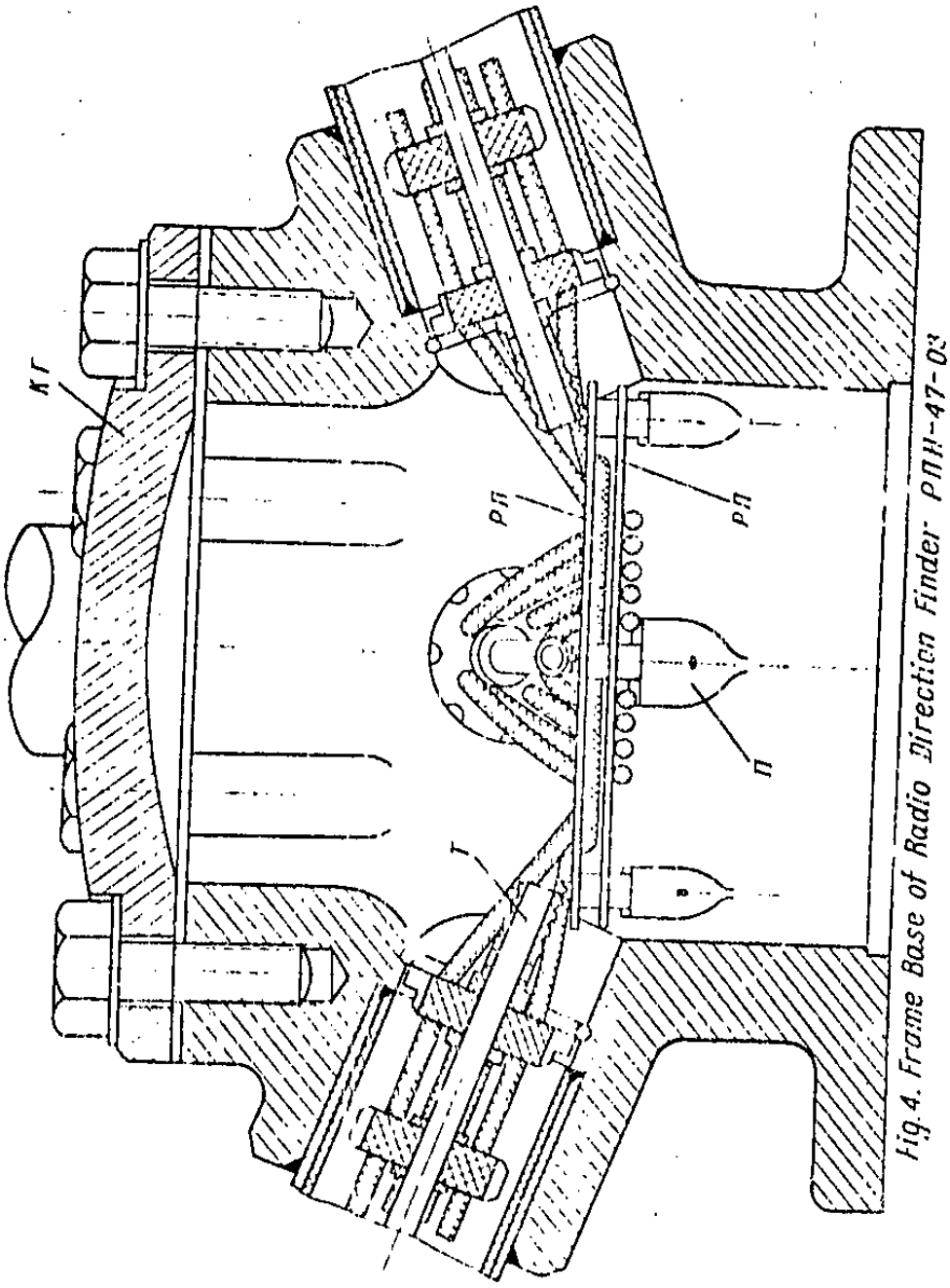

Fig. 4. Frame Base of Radio Direction Finder РПИ-47-03

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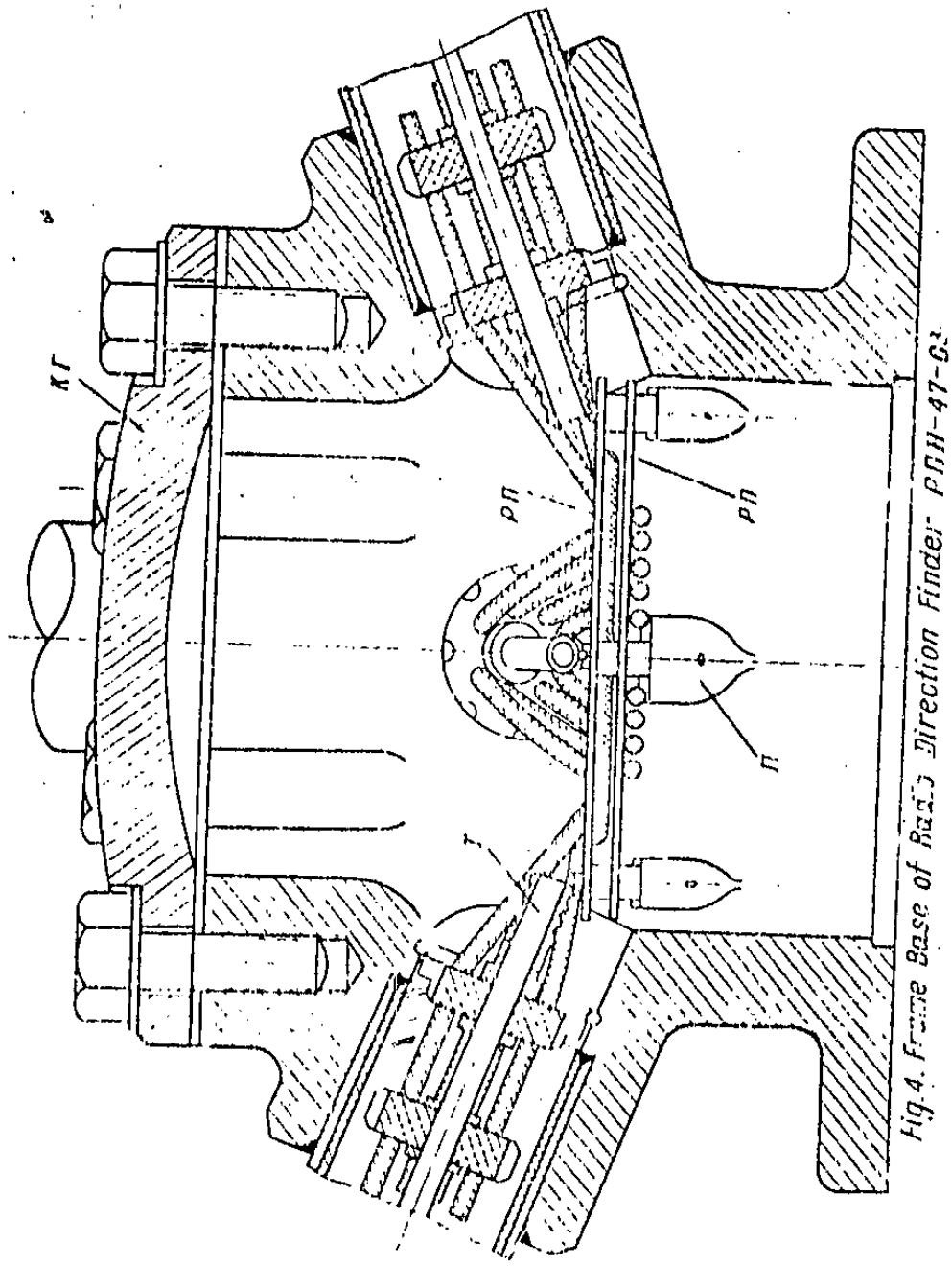

Fig.4. Frame Base of Radio Direction Finder РПН-47-62

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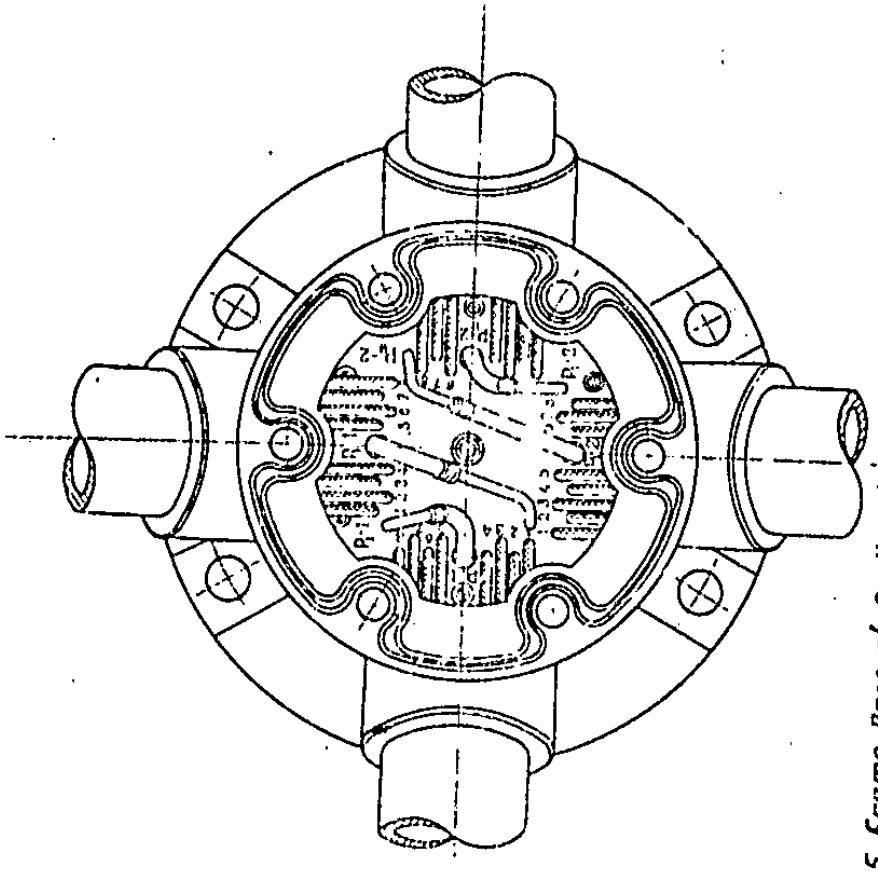

Fig.5. Frame Base of Radio Direction Finder PNH-47-03 with Cover Removed

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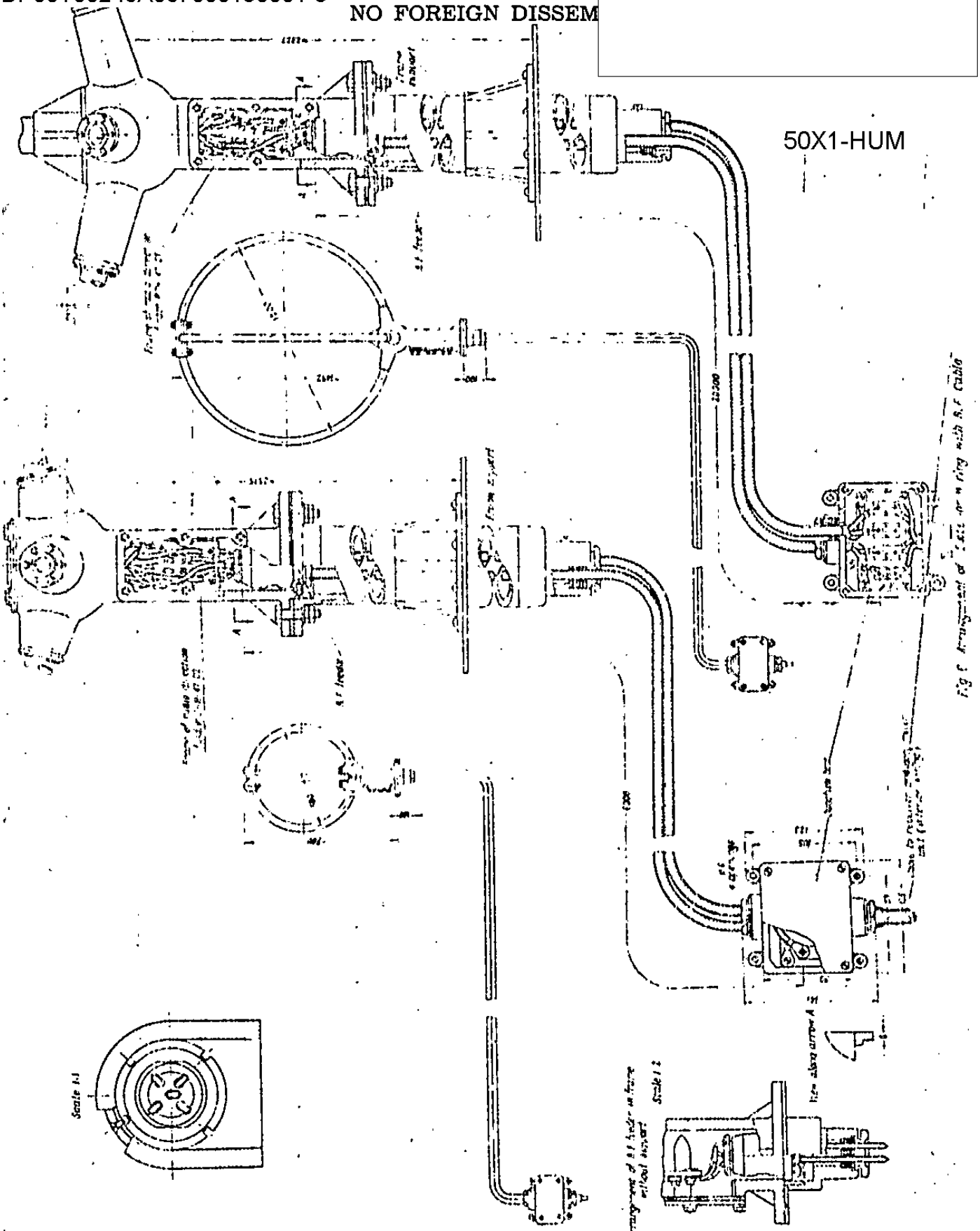

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